DOCUMENT RESUME

ED 215 229 CE 032 226

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TITLE Measures of Participation in Vocational Education: Enrollments, Students, and Exposure.
INSTITUTION American Institutes for Research in the Behavioral Sciences, Palo Alto, Calif.
SPONS AGENCY Department of Education, Washington, DC. Office of Planning, Budget, and Evaluation.
PUB DATE Aug 80
CONTRACT HEW-100-79-0181
NOTE 48p.

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Educational Research; *Enrollment; *Enrollment Projections; Enrollment Rate; Enrollment Trends; *Participation; *Secondary Education; *Vocational Education

ABSTRACT

This analysis reviews Bureau of Occupational and Adult Education (BOAE) vocational education enrollment statistics and compares them with a survey of vocational students in public secondary schools conducted in 1972 by the National Center for Education Statistics (NCES). Following an introduction, a brief review is provided of official BOAE FY 1978 secondary vocational education enrollment statistics. It includes a short discussion of several vocational education accounting concepts and identifies important reporting procedures with bearing on data interpretation. The section following uses NCES data to refine the picture provided by the BOAE numbers for 1973. It examines course enrollments disaggregated into unduplicated counts of persons taking one or more vocational courses, and these are converted into full-time equivalent program and non-program students. The fourth section provides estimates of the number of secondary students in occupational programs in FY 1978 and forecasts increases and declines through FY 1987. Three estimates are made for FY 1978, and two projections are made for later years based on differing assumptions. The final section explores implications of the findings, including substantial revision of estimated costs per vocational student and future research on vocational education effectiveness that is more cognizant of the differential exposure patterns among vocational program areas. (YLB)

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Measures of Participation in Vocational Education: Enrollments, Students, and Exposure

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August 1980

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ACKNOWLEDGMENTS

We would like to thank our colleague Rob Barnes for his help and encouragement throughout this effort and for his thoughtful comments on earlier drafts. We would also like to thank Steve Jung for his careful and constructive review of an early draft. Needless to say, the authors take full responsibility for any flaws or omissions that remain.

Measures of Participation in Vocational Education: Enrollments, Students, and Exposure

Lawrence L. Brown, III
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Executive Summary

Within the next few months, the Administration and Congress will begin to consider reauthorization of the Vocational Education Amendments of 1976. Many questions about efficacy, cost, and demand for vocational programs will be answered by referring to the official enrollment statistics published annually by the Bureau of Occupational and Adult Education (BOAE). The purpose of this analysis is to review these statistics to determine what they do and do not tell us about the vocational education enterprise by comparing them to a more comprehensive, independent information source: a survey of vocational students in public secondary schools conducted in 1972 by the National Center for Education Statistics (NCES).

A brief review of the BOAE FY 1978 secondary vocational education enrollment statistics is provided, including a discussion of several vocational education "accounting" concepts and various reporting procedures that have a bearing on interpretation of the official data. A variety of reasons are given for not accepting these official numbers at face value.

The advantages and disadvantages of the NCES 1972 vocational education survey are described: (1) vocational program enrollees are distinguished from students merely taking vocational electives; (2) course exposure data are particularly rich; (3) analyses can be in terms of either course enrollments or unduplicated vocational students; (4) there is no duplication resulting from short-term course enrollments or undocumented state accounting practices; (5) the survey methodology is well documented; (6) coverage of occupational students below the postsecondary level is exceptional; however, (7) coverage is poor to nonexistent for non-occupational vocational students (e.g., special program and consumer-homemaking students). The NCES survey makes it apparent that the practice of reporting course enrollments rather than students can be used to overstate the amount of vocational participation. When adjusted for multiple enrollments by a student, the survey's estimate of 4.5 million occupational course enrollments is reduced to less than 3.2 unduplicated students, and the 3.5 million course enrollments by program enrollees is reduced to 2.5 million unduplicated program students. This is 38 percent lower than the number of occupational program course enrollments reported by BOAE for school year 1972-73. By producing unduplicated student counts, the apparent fall 1972 participation in occupation programs is decreased from 25 to 18 percent of all public secondary school students.

When dealing merely with average numbers of courses taken, occupational program students do not appear to be exposed to much vocational education. Overall course-taking averages between 1-1/3 and 1-1/2 vocational courses per student taking any vocational education, and program majors, who presumably have strong commitments to vocational education, take only as many courses as their peers who are taking vocational electives. Course load averages gloss over some rather significant exposure differences between program and nonprogram students, however. When courses are weighted by the amount of classroom exposure they provide (i.e., minutes per class, classes per week, weeks per course), it becomes apparent that program students actually receive half again as much vocational instruction as elective-takers, primarily because their class meetings are more likely to be two or three school periods long.

Data from the 1972 National Longitudinal Survey (NLS) are used to explore the educational "life-cycle" differences between occupational programs. Estimates are produced of what proportion of a program student's education consists of (1) vocational courses taken in the student's program area, (2) vocational courses taken outside the program area, and (3) nonvocational courses. When combined with measures of when students first enrolled in an occupational program, these data expose large differences in the educational careers of students in the various occupational program areas.

Based on what was learned from the NCES survey, the analysis returns to the BOAE summary statistics for 1978 and other recent data sources to provide estimates of the number of secondary students currently enrolled in occupational programs and to forecast levels of activity in the near future for vocational education. Using accurate projections by NCES of the number of public secondary students each year through 1987, high and low projections of the future numbers of occupational program students were produced based on differing sets of assumptions. Given the directions in which these assumptions are probably incorrect and the effects of the assumptions on the projections, it is likely that future values will be somewhere between the two projections. The high projection estimated 3.2 million occupational program students in public secondary schools in 1980, increasing to 3.4 million by 1987. The low projection estimated 2.4 million occupational program students in 1980, decreasing to 2.1 million in 1987.

In the final section, the implications of the preceding analyses are discussed. Reductions in the estimated number of vocational students will certainly increase the estimated cost per student, and costs per full-time equivalent vocational student, which are most appropriate for comparisons with the costs of other kinds of secondary education, will be approximately three times higher than the per-student costs. Also, the strikingly different patterns of educational exposure in the various occupational program areas strongly suggest that future studies of the effectiveness of vocational education should look at individual students and their activities rather than analyze averages computed over nonhomogeneous groups.

Measures of Participation in Vocational Education: Enrollments, Students, and Exposure

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1.0 Introduction

Within the next few months, the Administration and Congress will begin to consider reauthorization of the Vocational Education Amendments of 1976. At that time, questions will be raised about the efficacy, cost, and demand for vocational programs. Many of these questions will doubtless be answered by referring to the official enrollment statistics that are published annually by the Department's Bureau of Occupational and Adult Education (BOAE). The purpose of this analysis is to review these numbers to determine just what they do and do not tell us about the vocational education enterprise. Since it is common practice for vocational educators to use these data to draw conclusions about the program, we will be particularly concerned with delimiting the kinds of assertions that these data will safely support.

To place the official statistics in perspective, we intend to compare the vocational training picture they paint with the picture painted by a more comprehensive, independent information source. In this way, we hope to provide some insight into the credibility of the official picture and its utility for federal policymakers. To make the task manageable, we have chosen to limit our attention to secondary level vocational education.

The organization of this paper is as follows. The next section provides a brief review of the official BOAE FY 1978 secondary vocational education enrollment statistics. This review includes a short discussion of several vocational education "accounting" concepts and identifies important reporting procedures that have a bearing on any interpretation of the official data.

The following section steps back to the baseline year of FY 1973 and uses an independent vocational education data source to refine the picture that is provided by the BOAE numbers for that year. In this section, we are particularly interested in improving our understanding of the kind of educational experience that is provided to secondary level vocational students. Basically, we examine what happens when course enrollments are decomposed into unduplicated counts of persons taking one or more vocational courses and these in turn are converted into full-time equivalent program and non-program students.

The fourth section returns to FY 1978, provides estimates of the number of secondary students enrolled in occupational programs in that year, and forecasts the increases and declines of such students through FY 1987. In particular, three estimates are provided for FY 1978 and two projections are made for later years based on differing assumptions.

The final section explores some of the implications of the findings that were discussed. Estimated costs per vocational student may have to be substantially revised. In addition, future research on the effectiveness of vocational education will have to be more cognizant of the differential exposure patterns among vocational program areas.

2.0 Interpreting the Official Statistics

Each year, the Bureau of Occupational and Adult Education (BOAE) publishes national statistics on participation in federally assisted public sector vocational education programs. Table 1 summarizes these enrollment figures for secondary level vocational education (grades 7-12) in school year 1978. According to these official numbers, 10.2 million students were enrolled in federally assisted secondary level vocational programs in 1978. This number amounts to more than two-thirds of all public school students enrolled in grades 9-12 for that year. To appreciate fully the magnitude of this claim, one must realize that the figure refers only to persons enrolled in vocational programs, not to persons in vocational courses.

TABLE 1

Enrollment (Aggregate Course Memberships) in Public Secondary Vocational Education, by Program, Program Year 1978 (July 1, 1977 - June 30, 1978)

Programs	Enrollments
Grand Total (unduplicated)	10,236,117
Occupational Preparation	4,940,997
Agriculture	715,272
Distribution	397,429
Health	131,907
Occupational Home Economics	252,566
Office	1,934,722
Technical	39,273
Trades and Industry	1,469,828
Special Programs	3,223,774
Guidance	1,455,126
Remedial	48,858
Industrial Arts	1,479,121
Other Not Elsewhere Classified	240,669
Consumer and Homemaking	2,795,949

SOURCE: Summary Data, Vocational Education, Program Year 1978. Bureau of Occupational and Adult Education, page 1.

Definitions will help to explain our surprise. In the parlance of vocational educators, these two concepts, program enrollees and course-takers, are quite different. Specifically, a vocational course-taker may be anyone receiving at least some vocational instruction, but a program participant should be enrolled in "a planned sequence of courses, services, or activities designed to meet an occupational objective."[1] Note that strict adherence to this definition should effectively exclude from the official course enrollment counts all academic and general curriculum vocational elective-takers, as well as anyone else not enrolled in a prescribed sequence of vocational courses. Similarly, students enrolled in vocational programs or courses that are not recognized in a state's approved plan for vocational and technical education (and thus are not eligible for federal support) should be excluded from the official course enrollment counts that states report to the Bureau.

With an understanding of the preceding definitions, the official participation claim is truly impressive. Indeed, if one accepts at face value the 10.2 million program enrollment figure, one must logically reach at least two kinds of conclusions about participation in vocational education. First, the figure suggests that impressively large numbers of secondary school students are receiving substantial amounts of vocational instruction (i.e., if the 10.2 million are enrolled in various "sequences" of courses). Second, because sizable numbers of elective-takers and other vocational students are by definition excluded from the official reckoning of vocational participation, one must also conclude that 10.2 million course enrollments actually understates total demand for secondary level vocational education.

In fact, however, there are a variety of reasons why one should not accept these official numbers at face value. One of these has to do with whether all of these students are actually enrolled in programs. It would appear that the official statistics distinguish among three broad categories of vocational program enrollments: (1) occupational preparation,

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1 Critical issues section of the vocational education appendix to the final regulations of the Education Amendments of 1976 (pp. 459-460).

(2) consumer-homemaking, and (3) special programs. A closer examination indicates that only those enrolled in the first category, and perhaps a small portion of those in the second, are actually participating in sequences of courses that could accord with the definition of programs. Indeed, a review of the official reporting forms and state reports suggests that classification as participating in special "programs" is generally an automatic consequence of taking a single prevocational career guidance or industrial arts course.

Similarly, even though the BOAE reporting form distinguishes nine varieties of consumer-homemaking programs, only one ("Comprehensive Homemaking") appears broad enough to be the focus of a student's high school program. The other "programs" sound like, and often turn out to be, single courses (e.g., "Child Development," "Family Relations"). Since the bulk of these "programs" do not appear to be programs at all but rather to be single courses, it would seem that the original assumptions about participation in high school vocational education need to be reconsidered. In particular, it would appear necessary to revise downward our original estimate of the number of high school students who are receiving substantial amounts of vocational instruction.

Unfortunately, the official statistics are not amenable to such rational analysis or adjustments. The "unduplicated program enrollment" total of 10.2 million cannot be calculated merely by summing the enrollment subtotals for the three separate "program" subcategories. Doing so yields approximately 11 million course enrollments, about 800,000 more than the official total. This result suggests strongly that a substantial number of students are being counted in more than one course across (and perhaps within) each vocational subcategory. While the official grand total of 10.2 million course enrollments is labeled "unduplicated," there is no way to check this contention since some of the vocational subcategory enrollments must duplicate one another. Thus, not only is it impossible to adjust the grand total by subtracting out all non-program course enrollments (e.g., subtracting the 3.2 million "duplicated" special program enrollments from the "unduplicated" total would yield an underestimate), it is equally impossible to determine just how many students in

each of the subcategories generated these enrollment counts. The data that are reported cannot reasonably be disaggregated.

These practical difficulties in estimating levels and types of vocational participation from official enrollment data will come as no surprise to those familiar with the procedures used to collect and compile the SOAE statistics. Quite simply, the state and federal agencies responsible for providing these statistics are generally one or more steps removed from the districts and schools that actually furnish the services. Various agencies have different notions about how vocational training activities should be conceptualized. Thus, two states can report noncomparable counts using the same federal labels. Since the federal government has to accept just about anything that is reported as long as it has an appropriate name, it is not particularly difficult to understand how duplication can occur.

A few examples may both clarify this point and illustrate why federal policymakers should be extremely cautious about drawing straightforward conclusions from these data.

First, it should be noted that these official statistics report the sum of all participation that has occurred over an entire school year. From one point of view (presumably the federal government's), such figures are meaningful only when they refer either to the total number of students who have taken one or more courses over the year or to some standardized contact hour measure. That is, if a student is enrolled in a one-year sequence of two 18-week typing courses (e.g., "Typing 1 and 2"), the student should count as only one enrollment or, better yet, should be converted into a standardized "full-time equivalent" (FTE) enrollment. From another perspective, it may make better sense and be easier to count merely courses taken. In the preceding example, one would count the student twice, once for each class enrollment. This might be the perspective of a state agency whose accounting system is so constructed that it does not permit such school-level refinements as unduplicated student counts or FTE enrollment counts or, alternatively, one that has historically used aggregate course memberships as a rough measure of demand when planning

its programs. The ways in which data are collected tend to be influenced by the anticipated uses of the data, and federal notions of accountability and policy research have not usually been given high priority by state systems.

Unfortunately, although both of the above points of view are understandable, only the first permits the kinds of interstate assessments and national aggregations that must be made at the federal level. It is especially unfortunate, then, that both types of accounting seem to find their way into the official federal statistics. If it desires to do so, a state offering one year of typing instruction under two separate 18-week course titles can contribute twice as many course enrollments to the national totals as a state offering the same course to an identical number of students but in the form of one 36-week instructional sequence. Also, if a state estimates program enrollments as the sum of program course enrollments, then a trade and industry program participant taking four different trade and industry courses could be counted four times. Worse yet, if each of the four courses were of the short-term variety previously described, this one student could conceivably be counted eight times. While current estimates of short-term course enrollments do not exist, data from 1972-73 suggest that the number may be substantial. In October of 1972, fully 12 percent of all secondary students who were enrolled in a vocational program were taking courses lasting 18 or fewer weeks.[2] It is unlikely that all such students end up being counted more than once. Those who do, however, will have a significant impact on the national totals and on the kinds of inferences that can reasonably be drawn from them.

A similar situation can occur when a student is counted twice because the single course he is taking happens to be part of two or more different "programs." This can happen in a variety of ways: between occupational home economics and consumer-homemaking (e.g., courses common to "Care and

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2 Special tabulations from the 1972 NCES survey of public secondary students in vocational courses indicate that four-fifths of these "short-term" students were taking half-year courses. The remaining students were in vocational courses lasting less than 18 weeks.

Guidance of Children," an occupational program, and "Child Development," a non-occupational consumer-homemaking program) or among several related occupational preparation programs (e.g., "Electrical Occupations," a trade and industry course, and "Electrical Technology," a technical education course). Since course enrollments are widely used to estimate program enrollments, BOAE has recognized this problem and asks the states to "unduplicate" such counts by reporting a student only once under a single program area. Unfortunately, states differ in their ability or willingness to subtract out such overlapping enrollment claims.

Changes over time with respect to state accounting methods also have the effect of invalidating most comparisons of reported participation levels. Lack of comparability over time is a common problem in statistical work, but it has particularly extensive and critical applications to the official statistics of secondary vocational education. Between FY 1976 and 1978, for example, the grand total for secondary vocational education increased by 2.1 million enrollments. Most of this increase--1.7 million enrollments--came from increased participation in special programs, which more than doubled over the two-year period. It is likely that changes in definitions, not enrollments, account for most of this increase.

From the few illustrations we have given, it should be obvious that drawing valid and reliable conclusions from these official statistics is a difficult task. Undocumented differences in the accounting methods used by the states, plus the federal government's inability to check thoroughly every number that it receives, render these data incapable of precise interpretation and make all interstate comparisons and analyses questionable.

More discouraging is the fact that these various uncontrolled practices render even the most basic national aggregates imprecise and questionable. Thus, even the grand total of occupational preparation, consumer-homemaking, and special program enrollments is an unusable number representing a potpourri composite of student counts and aggregate course memberships that have been accumulated by 50 different accounting systems over the school years of 50 different states. It would appear that we

must look elsewhere if an accurate picture of the number of students participating in high school vocational education is our aim.

3.0 An Alternative Source of Participation Estimates

In the fall of 1972, the National Center for Education Statistics (NCES) conducted a survey of vocational students in public secondary schools. The students selected were those taking one or more vocational courses in schools offering occupational curricula in any of grades 9 through 12. These institutions included comprehensive high schools, special secondary vocational schools, area vocational schools, and school districts offering occupational preparation programs.

Since 1972, very little use has been made of these survey results. Although one NCES report based on the effort was published in 1974, the report was devoted entirely to vocational course enrollments.[3] This is unfortunate. The survey design permits estimates of students as well as course enrollments and, as a result, can provide useful insights about how reporting practices affect official participation statistics. Because we intend to draw heavily upon these data, it may be well to note their advantages and limitations.

First, the survey provides detailed information about the course-taking behavior of vocational students attending schools included in the study universe. As a consequence, vocational program enrollees can be distinguished from students who are merely taking vocational electives. Course exposure data are particularly rich and include information bearing on the number of vocational courses being taken, course intensity and length (e.g., minutes per class, classes per week, and weeks per course), and the number of years enrolled in a program. These data are important because they permit one to calculate contact hour measures of participation.

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3 Characteristics of Students and Staff: 1972, Nicholas A. Osso, National Center for Education Statistics, Washington, D.C., U.S. Government Printing Office, 1974.

Although the survey tile was originally designed to generate enrollment statistics, it has been reweighted recently to provide accurate estimates of unduplicated student participation in vocational education. This is an important refinement. In effect, it means that the data may now be used to investigate the kinds of distortions that result when participation is reported in terms of aggregate course memberships rather than in terms of students.

A third advantage to the NCES survey is that duplication resulting from short-term course enrollments (i.e., half-year or shorter courses) and undocumented state accounting practices is not a factor affecting these statistics. The survey is cross-sectional, and questionnaires were administered directly to school personnel and students. While moment-in-time estimates and self-reporting result in their own kinds of distortions, in our opinion the poor quality of the official statistics make this an acceptable trade-off. To guard against misconceptions, we will take pains to qualify our results and alert the reader when we think these and other design features might affect interpretations.

A fourth important advantage is that the survey methodology is well documented, with sampling errors furnished and universes explicitly defined. As a consequence, the analyst knows exactly what kinds of assertions can and cannot be supported by the data. This is a distinct advantage over the official statistics.

Finally, because the survey was designed specifically to capture information about vocational education in secondary schools offering occupational preparation programs, coverage of student participation in these programs is exceptional. Indeed, since occupational students were included even if they were attending schools not covered by a state vocational education plan, the only occupational students below the postsecondary level that the NCES survey would fail to capture are those few 7th and 8th graders who were enrolled in programs offered by elementary or junior high schools lacking a 9th grade class. In short, we feel confident that these data furnish a relatively accurate picture of participation in secondary level occupational courses and programs as of October 1972.

Unfortunately, the same coverage claims cannot be made for special program and consumer-homemaking students. Special program enrollees were excluded from the survey sample (unless, of course, they were also taking some other vocational course), and some consumer-homemaking students were excluded because they were not attending schools covered by the survey universe (i.e., they were attending either elementary schools, middle or junior high schools without a 9th grade, or secondary schools without any occupational programs in grades 9 through 12). Because these are major limitations, we will draw less heavily from the data that are available on participation in consumer-homemaking programs and will focus our attention instead on the more reliable information that is available for occupational preparation. While we would like to have conducted a broader investigation, the data will not safely support such an effort. Similarly, because these data are now almost eight years old, we will restrict our analysis almost entirely to issues bearing on the accuracy of official participation statistics.

3.1 Participation in Occupational Vocational Education

Table 2 shows the area-by-area breakdown of total occupational course enrollments derived from the October 1972 NCES survey. These are aggregate enrollments for both program enrollees and elective-takers. Only courses currently being taken at the time of the survey are counted. Although these course enrollment counts are unduplicted, the number of students responsible for these enrollments is not unduplicated. Course enrollments reported by students who failed to indicate whether they were program enrollees or elective-takers have been excluded from the table to simplify subsequent discussions. Since these "ambiguous" students account for only one percent of the total occupational universe, their exclusion has had the negligible effect of reducing the overall total by only 47,000 course enrollments. Inclusion of these enrollments would not change the distribution of enrollments over the occupational areas by more than 0.2 percent.

As may be seen, occupational course enrollments stood at about 4.5 million in October 1972. The largest share of these were generated in the

TABLE 2

Course Enrollments in Public Secondary Occupational Education by Occupational Area, October 1972[a]

Occupational Area	Enrollments (000)	Percent
TOTAL	4,513.3[a]	100.0
Agriculture	721.5	16.0
Distribution	317.9	7.0
Health	106.7	2.4
Occupational Home Economics	259.1	5.7
Office	1,606.6	35.6
Technical	233.4	5.0
Trade and Industry	1,278.2	28.3

[a] To simply subsequent discussions, table omits approximately 47,000 course enrollments generated by persons who could not unambiguously be assigned to a program status category. Inclusion of these enrollments would not change the distribution of enrollments over the occupational areas by more than 0.2 percent.

SOURCE: Special Tabulations, NCES Survey of Public Secondary Vocational Education, October 1972.

office category, either by office program students or by elective-takers whose course-mix was predominantly in the office category. Trade and industry enrollments were next most prevalent, and these in turn were followed by those in agriculture. Almost 80 percent of all course enrollments were generated by program enrollees and elective-takers in these three specialities. By contrast, very few enrollments were generated by course-takers in any of the four remaining areas. By far the smallest number was contributed by students taking health occupational courses, accounting for 2.4 percent of all occupational course enrollments.

At this point, a brief methodological aside may be in order. The preceding figures, and all subsequent ones as well, were derived from a recode of student responses to questions on program status, major area, and number and type of courses. Specifically, program students were assigned to their declared program area category, or if they failed to indicate a "major," to the area in which they were taking most of their classes.[4] In the case of ties, students and their associated course enrollments were assigned randomly to one of their course areas. Elective-takers were assigned to an area in essentially the same manner, except that the program area declaration obviously could not be used since it did not exist. These imputation procedures differ somewhat from those used by NCES in its publication Characteristics of Students and Staff, 1972. In that report, all enrollments were simply assigned to the course area of the class in which the student was sampled. Although this "sample class" or "current activity" imputation procedure seems reasonable for elective-takers, it seems less so for program students who are presumably enrolled in sequences of courses that could stretch over several years.

Naturally, these methodological differences (plus the fact that we have omitted 47,000 "ambiguous" enrollments) have resulted in some changes. Thus, compared with the NCES publication, this study reports larger numbers of course enrollments in agriculture and health, but fewer enrollments in all other occupational specialities. Even so, our recode procedures have

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[4] Fewer than two percent of all program students failed to indicate a major in one of the standard program areas.

increased the total number of occupational enrollments by about 14,000 because many students that we assigned to the occupational program universe based on program area declaration were classified as non-occupational students by NCES since they happen to have been sampled in a consumer-homemaking class. While we feel that NCES methods may come closer than ours to capturing the actual survey day course-taking behavior of program students, we also feel that survey day behavior may be an inappropriate way to classify these students. Whether agriculture program enrollees, for example, are taking any courses in other vocational areas should have no bearing on their classification as declared agriculture majors.[5]

Having dispensed with these methodological preliminaries, it is now time to turn our attention from course enrollments to students. Specifically, we would now like to know just how many students are responsible for these aggregate course memberships and what proportion of the students are in programs as opposed to vocational electives. Since the original NCES publication based on this survey reported only aggregated course enrollments for the country, we have reweighted the survey data ourselves to generate unduplicated student counts.[6] Table 3 shows the results of these efforts.

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5 The question of response error in the majors reported by program enrollees is clearly not a separate issue. One might expect that some students would have difficulty distinguishing between the technical and trade areas, for example, or between occupational home economics and consumer-homemaking. Unfortunately, the only other information source that could be used to validate the declaration of majors is not independent, may be no more reliable, and is certainly less valid: namely, the description of vocational courses the student reports that he or she is currently taking. A mismatch between the vocational area in which a student is taking the most courses and the area reported as being his or her major may be an indication of misunderstanding and response error, but it may also merely be the result of the student's eclectic course choices in the current semester. As compared to classification based entirely on courses being taken, a higher percentage of program students declared their majors to be in the health and technical areas, and a lower percentage declared their majors to be in distribution or trade and industry. As noted earlier, however, given the alternative, these are errors we are willing to live with.

6 The files were reweighted by the American Institutes for Research (AIR) with the assistance of the original NCES contractor WESTAT Research Inc. Detailed documentation for the data file, the original survey design, and the various weighting and reweighting procedures is available in a report prepared by AIR for the Office of Technical and Analytic Systems, Office of Planning and Budgeting, Education Department.

TABLE 3

Students and Enrollments Per Student in Occupational Programs and Courses by Program Status and Occupational Area, October 1972

Program Area	All Occupational Students		Occupational Students in Programs		Students Taking Occupational Electives	
	N (000)	Ratio of Enrollments to Students	N (000)	Ratio of Enrollments to Students	N (000)	Ratio of Enrollments to Students
TOTALS	3,179.6	1.42	2,467.3	1.44	712.3	1.36
Percent All Students	100.		77.6		22.4	
Agriculture	567.2	1.27	528.3	1.27	39.0	1.30
Distribution	219.8	1.45	189.8	1.45	30.0	1.43
Health	83.2	1.28	71.5	1.28	11.7	1.30
Occupation Home Economics	203.6	1.27	162.2	1.27	41.4	1.27
Office	940.2	1.70	594.8	1.87	345.5	1.43
Technical	169.1	1.32	127.5	1.36	41.6	1.21
Trade and Industry	996.4	1.28	793.3	1.28	203.1	1.29

SOURCE: Special Tabulations, NCES Survey of Public Secondary Vocational Education, October 1972.

Several facts are of note here. First, it is apparent that the practice of reporting course enrollments rather than students can be used to overstate the amount of vocational participation. Whereas we began with 4.5 million total occupational course enrollments, adjusting for multiple enrollments by a student has reduced total participation by about 30 percent and has yielded an unduplicated student count of less than 3.2 million. Stated differently, the enrollment figures for occupational preparation courses are 42 percent higher than student participation (see the top figure in Column 2).

Student participation in some occupational specialties is more overstated by course enrollment counts than in others. Thus, enrollment figures are 70 percent higher than unduplicated student counts in the office area (about 670,000 "participants" are lost when duplicate counts are eliminated), while student participation in distribution courses is overstated by 45 percent. The remaining specialities are less affected but are affected nonetheless.

For our purposes, the figures for program students are particularly interesting since they provide several insights about the numbers that are reported in the official publications. As may be seen, using course enrollments rather than unduplicated student counts overstates student participation in this sector by 44 percent. In absolute terms, adjusting for duplication reduces the number of occupational program "participants" from 3.5 million course enrollments to 2.5 million students. Since it is common practice to measure participation in vocational education by reporting secondary vocational program enrollments as a proportion of all secondary school students,[7] it is instructive to note that by producing unduplicated student counts, we have reduced the apparent fall 1972 parti-

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7 For example, see the following: Status of Vocational Education, School Year 1975-76, National Center for Research in Vocational Education, Ohio State University, 1978; Senate Report 94-882 on the Educational Amendments of 1976 with Supplemental Views, 94th Congress, 2nd session, pp. 48-50.

cipation in these programs from 25 to 18 percent.[8] If these aggregate course enrollment and student totals are even close to being accurate, they should carry an important warning to vocational education policy-makers: beware of those who bear overstated statistics in order to buttress their claims about the popularity of vocational education.

Although a more appropriate measure than course enrollments in the student population, the proportion of all students enrolled in vocational courses or programs is nevertheless a poor measure of effort in vocational education. Clearly, neither the number nor the proportion of students enrolled in vocational education tells one anything about the amount of vocational instruction that these students receive. Since all students count equally toward the total, even though some may be taking more course work than others, in its own way the raw count of vocational program students is nearly as gross a measure of vocational activity as the aggregate count of vocational courses. If we wish to gauge participation in vocational education more accurately, we need more refined measures that take contact hour and other exposure differences among vocational students into account.

One very rough step in this direction has already been taken in Table 3 with the inclusion of the average number of vocational courses taken by different types of vocational students. This statistic tells us something new about participation in occupational vocational education. While earlier we noted that the number of course enrollments in office specialties was 70 percent higher than the number of students, now we note that this is because a large number of these students were taking two or more vocational courses when the survey was conducted.

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8 These percentages are based on a total of 13.9 million public school students in grades 9-12 in the fall of 1972. The percentages are actually a bit too high since some 7th and 8th grade students were included in the NCES survey. SOURCE: Projections of Education Statistics to 1986-87, 1978, Table 3, p. 16.

As one might expect, program students take more vocational courses on the average than do elective-takers, although the difference is surprisingly small (i.e., 1.44 versus 1.36 courses per student). This course-taking advantage accruing to program students is not, however, an across-the-board phenomenon. Indeed, a perusal of the area-by-area averages indicates that if an advantage exists, it exists almost entirely because office and technical majors tend to take more vocational courses than their non-program counterparts. The course-taking activities of students in the remaining specialties are about the same regardless of program status.

In general, advocates for vocational education will find that these statistics offer very little to cheer about. First, participation in terms of number of students is much lower than advertised by BOAE and others, especially for program students. Second, the number of vocational courses being taken by each student is not high. Overall course-taking averages between 1-1/3 and 1-1/2 courses per student. Third, except in two instances, program majors, who presumably have strong commitments to vocational education, take only as many courses as their elective-taking peers. When dealing merely with average numbers of courses taken, occupational program students do not appear to be exposed to much vocational education.

3.2 Exposure to Vocational Education

Actually, it is a bit premature to begin casting doubts about whether program students receive sufficient occupational education during high school. While we feel confident in concluding from these survey data that official proclamations about participation in occupational programs have historically been overstated, we feel less confident about using average number of courses taken as a measure of vocational activity. Clearly, some courses meet more often and for longer periods of time than others. Moreover, since programs can stretch over several years, a one-time snapshot is at best only suggestive. To reach even tentative conclusions about participation in these courses, we need to begin looking at more refined measures of exposure. Table 4, which looks at average weekly

TABLE 4

Average Weekly Vocational Contact Hours Per Pupil
by Program Status and Occupational Area, October 1972

Program Area	All Occupational Students	Occupational Students in Programs	Students Taking Occupational Electives	Ratio of Contact Hours of Program Students to Elective-Takers
TOTAL	8.53 (34%)[a]	9.31 (37%)	5.96 (24%)	1.56
Agriculture	6.85 (27%)	6.91 (28%)	6.15 (25%)	1.12
Distribution	7.20 (29%)	7.34 (29%)	6.09 (24%)	1.21
Health	9.72 (39%)	10.36 (41%)	5.83 (23%)	1.78
Occup. Home Economics	7.95 (32%)	8.46 (34%)	6.14 (25%)	1.38
Office	8.86 (35%)	10.47 (42%)	6.26 (25%)	1.67
Technical	8.03 (32%)	8.99 (36%)	5.23 (21%)	1.72
Trade and Industry	9.60 (38%)	10.65 (43%)	5.50 (22%)	1.94

[a] Figures in parentheses indicate the proportion of a standardized 25-hour per week course load represented by the vocational contact hours.

SOURCE: Special Tabulations, NCES Survey of Public Secondary Vocational Education, October 1972.

vocational contact hours for students taking courses in the first semester of 1972, is a step in this direction. Since these contact hour averages take course load and class length differences into account simultaneously, they enhance our picture of vocational activity. We still have a snapshot, but it is more in focus than before.

Comparing Table 4 with Table 3 confirms our doubts about using vocational course load averages to measure participation. As is evident, course load averages gloss over some rather significant exposure differences between program and nonprogram students. While previous statistics indicated that the average number of vocational courses taken by program enrollees is just barely greater than the average course load of other students, these new data show that, compared with elective-takers, program students receive about 56 percent more vocational instruction (see the last column of Table 4).[9]

Comparing the statistics in Table 3 with those in Table 4 also changes some original impressions about the relative instructional benefits accruing to program majors in the different occupational areas. For example, while course load data indicated that trade and industry program students take slightly fewer courses than trade and industry elective-takers, these contact hour statistics show that the courses these program students do take result in almost twice as many hours of vocational instruction. The largest exposure differentials between program and nonprogram students now accrue to trade and industry majors, followed in order by health, technical, office, and occupational home economics program students. As can be seen, distribution and agriculture majors are exposed to only slightly more vocational instruction than students taking

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9 Because the average number of weekly meetings per course is about the same regardless of student program status (about 5 classes per week), these contact hour differences are almost entirely due to class length variations. For example, special tabulations from the NCES file indicate that while the classes of nonprogram students average only about 55 minutes, those of program students average an hour-and-a-half. Health, technical, and trade and industry program students are especially likely to take courses with class meetings two or three times as long as the usual class period.

electives in those areas. On the whole, however, these contact hour statistics lead to a more positive assessment of the relative instructional value of being in versus being out of a program.

Table 4 also measures the contact hour statistics against a 25-hour per week course load (i.e., five one-hour classes each day, five days a week). Occupational students in programs spend on the average from 28 percent (agriculture students) to 43 percent (trade and industry students) of a "full-time" course load in vocational classes. Overall, program students invest one-third of each school week in vocational instruction. Whether or not this average proportion is considered to be sufficient exposure for a student with a long-range vocational commitment, one should remember that large numbers of these students are taking only a single course (while the average exposure is increased by students taking two, three, or more vocational courses). Since there is a wide range in contact hours among program students, average statistics may draw attention away from a sizable minority of occupational students who may be receiving insufficient preparation in high school.

Table 5 provides a notion of the actual amount of vocational participation in our universe of occupational course-takers. It shows totals for the number of full-time equivalent (FTE) 25-hour per week vocational students in our sample.[10] One way to interpret these frequencies is to think of them as representing the number of 25-hour instructional weeks that were generated by the vocational activities of the 3.2 million occupational students. Multiplying these FTE totals by 25 would result in the total number of contact hours during one week in October 1972.

As one would expect, the number of FTE occupational student-weeks is much less than the number of occupational students. Since an average

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10 We do not mean to imply that occupational students should, or even could, spend all of their school time in vocational classes. The advantage of working with standardized FTE student-weeks is that it is a more accurate measure of the total effort invested in vocational education than either course enrollments or unduplicated student counts.

TABLE 5

Full-Time Equivalent Students[a] by Program Status
Occupational Area, October 1972

Program Area	All Occupational Students N (000)	Occupational Students in Programs (N (000)	Students Taking Occupational Electives N (000)
TOTAL	1,099.2	928.4	170.8
Agriculture	155.7	146.1	9.6
Distribution	64.3	56.9	7.4
Health	32.5	29.8	2.7
Occup. Home Economics	65.5	55.2	10.3
Office	336.7	249.9	86.8
Technical	54.7	46.0	8.7
Trade and Industry	389.8	344.5	45.3

[a] Standardized to a 25-hour per week course load.

SOURCE: Special Tabulations, NCES Survey of Public Secondary Vocational Education, October 1972.

student in our universe devotes 34 percent of a full week to vocational class work, our 3.2 million occupational students are responsible for only 1.1 million FTE weeks of vocational instruction. The largest adjustments naturally occur for the 712,000 students who are not enrolled in programs. Since their vocational classes are usually only one school period in length, they account for the equivalent of only 171,000 FTE students. The 2.5 million program enrollees are responsible for more than their share of the vocational contact time. Because they tend to enroll in a somewhat greater number of vocational courses than the elective-takers and because their classes often last two or three school periods, they account for the equivalent of 928,000 FTE students, or 84 percent of all occupational student contact hours.

As we could have deduced from our review of contact hour differences (Table 4), student counts overestimate activity more in some areas than in others. For example, while there are slightly fewer than one million agriculture, distribution, and occupational home economics course-takers, these students are responsible for only 285,000 FTE weeks of vocational instruction. In contrast, trade and industry students, who also number slightly fewer than one million, are responsible for 390,000 FTE weeks of vocational instruction. In terms of student contact hours, the trade and industry and office areas account for 66 percent of all vocational activity.

What are we to conclude from these findings? First, any attempt to portray vocational activity in terms of course enrollments or unadjusted student totals is bound to distort the amount of activity by program area or by type of student because courses or students will be counted equally, without regard for differences in concentration of instruction. These inaccuracies will in turn lead to mistakes in depicting relative amounts of vocational activity. For example, we will make the mistake of concluding that occupational program participants represent 25 percent (using course enrollments) or 18 percent (using students) of all public secondary school activity in October 1972. In fact, it would be more correct to say

that occupational program activity amounted to about 928,000 FTE vocational students.[11]

Our picture of relative activity within the occupational preparation universe will also be distorted unless statistics are converted to FTEs or contact hours or some equivalent measure. Table 6 compares the relative shares of program enrollees versus elective-takers and of the seven occupational areas under the three types of measures we have discussed: course enrollments, unduplicated student counts, and student contact hours or FTEs. As compared to enrollments, converting to a standardized measure of contact time has the effects of (1) increasing the proportional share of program enrollees as compared to elective-takers, (2) increasing the shares of student activities in the health and trade and industry areas, and (3) decreasing the shares in the agriculture, distribution, and office areas.

3.3 A Closer Look at the Participation of Occupational Program Enrollees

Thus far, we have attempted merely to sharpen the cross-sectional picture of aggregate participation that is normally provided by official federal publications. In doing so, we have shown that the 4 million occupational program enrollments officially reported for 1972-73 probably reflected the course-taking activities of only about 2.5 million occupational majors. We have also suggested that taking contact hour differences into account would convert these 2.5 million program students to the equivalent of 23 million classroom contact hours per week or about 928,000 FTE (25 hours per week) students (Table 7).

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11 An accurate measure of occupational program activity as a proportion of all secondary school activity would be the ratio of the two in terms of FTEs. However, we do not have comparable statistics on contact hours for all secondary school students in October 1972. If one assumed that the 13.9 million public school students in grades 9-12 were taking 25 hours of classes each week on the average, then occupational program activity would amount to 6.7 percent of all participation in high school. Since it is likely that an average of 25 contact-hours per week is a bit high, occupational program activity probably accounted for 8 percent or more of all high school course work.

TABLE 6

Proportional Share of All Vocational Activity
in the Occupational Areas by Various Measures, October 1972

Program Area	Enrollments	Unduplicated Students	Student Contact Hours or FTEs
Program Enrollees	78.6%	77.6%	84.5%
Elective-Takers	21.4%	22.4%	15.5%
TOTAL	100%	100%	100%
Agriculture	16.0%	17.8%	14.2%
Distribution	7.0%	6.9%	5.8%
Health	2.4%	2.6%	3.0%
Occup. Home Economics	5.7%	6.4%	6.0%
Office	35.6%	29.6%	30.6%
Technical	5.0%	5.3%	5.0%
Trade and Industry	28.3%	31.3%	35.5%

SOURCE: Special Tabulations, NCES Survey of Public Secondary Vocational Education, October 1972.

TABLE 7

Summary Statistics: Occupational Preparation Course-Takers in BOAE and NCES Universes, 1972-73 (numbers in thousands)

Program Status	BOAE Course Enrollments	NCES Data		
		Enrollments	Students	FTEs
Total Occupational	3,956	4,513	3,180	1,099
In Programs	3,956	3,546	2,467	928
In Electives	NA	967	712	171

SOURCE: BOAE Summary Data for Vocational Education, FY 1973; Special Tabulations, NCES Survey of Public Secondary Vocational Education, October 1972.

While these are useful refinements, they are incomplete, at least insofar as program majors are concerned. Since program students are involved in planned sequences of courses that can extend over several years, cross-sectional descriptions of their course-taking activities may be misleading. Just as some courses meet more often and for longer periods of time than others, some programs concentrate large amounts of instruction over relatively short periods of time while others provide small individual "dosages" over long periods. To pick up these "program life-cycle" differences, it is necessary to go beyond point-in-time estimates of aggregate participation and examine the cumulative instructional experience of a single graduating high school cohort. As a further refinement, some notion of the content and composition of that instruction is needed. Specifically, we need to move beyond gross measures of vocational activity as of a particular moment and estimate what proportion of a program student's education consists of (1) vocational courses taken in the student's program area, (2) vocational courses taken outside the program area, and (3) nonvocational courses. In addition, it would be useful to know whether graduating high school seniors tend to have enrolled in their occupational programs in their junior and senior years or earlier, so as to know over how short or extended a period of time the vocational course-work in the program area was spread.

Table 8 is an attempt to provide this cumulative perspective. It summarizes the length of time enrolled in a program and the number of semester courses of vocational and nonvocational instruction taken in grades 10 through 12 by graduating seniors majoring in the various occupational areas.[12] In effect, the table furnishes a look at the high school instructional careers of seniors who were enrolled in vocational programs during the spring of 1972.

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12 In Table 8, students are categorized by program area according to their self-reported majors (as is true for the previous tables based on the NCES survey). Categorizing students according to school records concerning their majors, however, results in some differences in the average numbers of courses of various types taken, and therefore a version of Table 8 based on school records rather than student reports is appended to this paper. The differences between the two tables, although substantial in some cases, do not affect any of our major conclusions.

TABLE 8

Number and Full-Time Equivalent (FTE) Semester Courses Taken in Grades 10-12 by Public High School Seniors in Occupational Programs

Program Area	Mean Years in Program[a]	Total Voc. and Nonvoc. Courses		Vocational Education Courses						Nonvoc. Courses	
				Total Voc. Courses		Voc. Courses in Program Area		Voc. Courses Outside Program			
		#	FTEs[b]	#	FTEs[b]	#	FTEs[b]	#	FTEs[b]	#	FTEs[b]
Average of All Students in Occupational Programs[c]	2.1	31.9	27.3	7.7	9.3	5.2	6.8	2.5	2.4	24.2	18.2
Agriculture[d]	3.1	29.5	28.0	8.2	10.1	3.4	3.3	4.8	6.8	21.3	17.9
Distribution	1.5	29.3	23.0	6.6	5.9	2.6	2.6	4.0	3.3	22.7	17.1
Health	1.3	30.1	27.4	6.8	9.4	2.0	3.6	4.8	5.8	23.3	18.0
Office	2.2	35.2	28.4	8.8	9.0	6.8	7.4	2.0	1.6	26.4	19.4
Technical/Trade	1.9	30.4	27.8	7.0	10.3	5.5	9.0	1.5	1.3	23.4	17.5

[a] Mean years enrolled in the occupational program by the end of the senior year assuming that all students enrolled in a program at the beginning of a school year; based on NCES file.

[b] Total classroom contact time converted to full-time eqivalent (FTE) semester courses, with one FTE semester course being equal to 90 classroom hours (5 hours per week for 18 weeks); classroom contact time based on NCES file.

[c] When aggregating statistics for the five program areas, each program was weighted by the number of high school seniors enrolled in that program in the NCES survey.

[d] Students were assigned to program areas according to their self-reported majors.

SOURCE: 1972 National Longitudinal Survey (NLS); Special Tabulations, NCES Survey of Public Secondary Vocational Education, October 1972.

Table 8 is based primarily on data from the 1972 National Longitudinal Survey (NLS), with some adjustments and additions from the NCES survey. The National Longitudinal Survey population consists of all 12th graders enrolled during 1972 in all public and private schools in the United States. (Table 8 is based on the public school students only.) Schools were stratified according to various criteria and (except for schools in low income areas, with high black enrollments, or with low total enrollments) were sampled with equal probability. From each selected school, 18 students were randomly chosen to participate. The baseline survey of the senior class was conducted in the spring of 1972, and therefore the NLS participants are one cohort ahead of the seniors in the NCES study, who were surveyed in October 1972 and would graduate in 1973. The advantage of the NLS survey for our purposes is that information was collected concerning not only courses currently being taken but also courses taken in earlier years (in particular, courses taken before or after July 1969). This allows us to expand the snapshot supplied by the NCES survey to include longitudinal information about the educational careers of occupational program students in high school.

Two sets of figures are provided for the number of semester courses taken. The first set is based on a raw count of the number of semester courses taken by occupational program enrollees who were included in the NLS survey. These mean numbers of courses are unadjusted for differences in instructional exposure and were taken directly from the NLS survey file.

The second set of figures is based on the NLS data but has been adjusted using NCES course length statistics. Essentially, we have used the NCES data on minutes per class, classes per week, and weeks per course to calculate classroom exposure averages on each type of course and have used these to standardize the raw NLS course totals.[13] That is, we have

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13 Using the NCES data, 15 separate classroom exposure adjustment factors were calculated for occupational program majors. That is, three separate adjustment factors were calculated for students in each of the five program area categories: (1) a factor for courses taken in the program area; (2) a factor for vocational courses taken outside the student's program (i.e., vocational electives); and (3) a factor for nonvocational courses taken.

used the NCES and NLS figures to calculate rough estimates of the number of full-time equivalent (FTE) 90-hour semester courses taken by occupational program enrollees over the last three years of their high school careers.[14] A 90-hour standard for one FTE semester course is used because the most common course schedule is five one-hour classes per week for 18 weeks. Embedded in this standardizing procedure is the notion that a full three-year course load is the equivalent of approximately 30 FTE semester courses of instruction (i.e., about 10 courses of this length per year).

The rough, synthetic nature of these adjusted estimates cannot be overemphasized. In addition, the NLS occupational area categories are less detailed than those in the NCES file. This has caused us to collapse into one grouping the technical and trade-industry categories and to calculate adjustment factors for this new group by pooling the NCES exposure information for these two specialties. We have also had to omit home economics majors from our analysis because the NLS file does not distinguish between occupational and consumer-homemaking programs. After giving the matter some thought, it did not seem sensible to include this hybrid program in our investigation of occupational participation.

Given the compromises we have made, it would be a mistake to pretend that these estimates provide much more than approximations of the different instructional experiences of the various occupational students examined. In short, any conclusions that might be drawn from these estimates must be considered tentative and suggestive. With this cautionary note in mind, we now turn to Table 8.

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14 The NLS survey collected information on all courses taken since July 1969 and on courses taken before that time. We could report the total numbers of vocational courses taken by these high school seniors, including courses taken before their sophomore years, but we would not know over how many years prior to 10th grade the additional courses had been taken. To improve the interpretability of the data, the discussion has been restricted to the only definite time period available--the last three years of high school.

These results tend to confirm the distinctive character of the vocational education curriculum. The vocational courses in which occupational majors enroll are relatively numerous and tend to be longer in duration than a standard semester course of 90 classroom hours. An average vocational education major enrolls in 7.7 vocational courses over a three-year high school career, which turn out to be equivalent to more than 9 FTE semesters of instruction. In terms of contact hours, a vocational student spends about 34 percent of his or her time in vocational courses.

That vocational students do in fact tend to concentrate on a particular vocational field or specialty area is evidenced by the fact that about three-quarters of an average program student's vocational instruction takes place in the student's program area. Indeed, since classes taken in the student's program area are much longer on the average than course work taken in vocational electives or in nonvocational areas, it would appear that the average occupational major receives quite a lot of vocational instruction in terms of contact hours. While the average number of program area courses totals a bit more than five, these five courses actually represent almost seven full 90-hour units of instruction.

Not all programs of occupational study supply this much training, however. Distribution program students seem to be especially shortchanged, taking the equivalent of only 2.6 full semester courses in their program. Since this is the average, one wonders how many distribution students are taking only one semester course in the area during high school and what proportion of them are properly prepared for advanced training or employment following graduation. On the other hand, many of these students may be participating in cooperative education or work-study programs, and these occupational experiences outside of school would not be included under course work.

The first column of Table 8 contains the mean number of years students would be enrolled in occupational programs by the end of their senior year (based on the seniors in the NCES survey). These figures rest on two assumptions: (1) that the students had enrolled in the programs at the beginning of a school year and (2) that they would remain in the programs

until the end of the school year. The students were asked what year of their current vocational program they were enrolled in, and consequently students who switched programs during high school are not given credit for any years spent in a previous occupational program. The mean number of years in the program has been included in Table 8 in spite of these qualifications because it reveals some rather large differences among the program areas and because the mean, even if a bit artificial in this case, is more sensitive and discriminating than the modal or median number of years in the program.

The average occupational student is enrolled in a program for about two years during high school. Agriculture students stand out, however, since they are enrolled in the program for a mean of 3.1 years (with the median student enrolling in the freshman year).[15] At the other extreme, distribution and health students are the last to enroll in their programs, and consequently they average only a year-and-a-half or less in the program before graduating. Surprisingly enough, most seniors in these two occupational areas were not enrolled in the programs in their junior years. Length is balanced by intensity, however. The intensity of occupational education received in the various programs, both in terms of average number of courses taken each semester and the amount of weekly classroom time in each course, tends to be negatively correlated with the mean number of years enrolled in the program. By dividing the number of FTE semester courses taken in the program area by the mean number of years in the program, one can calculate that agriculture students average about one FTE semester course per year in the program, while technical and trade students take an average of almost five FTE semester courses in the program area during each year that they are enrolled.

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15 Since agriculture students tend to enroll in their program at the earliest age, they are most likely to have taken vocational courses in the program area prior to 10th grade. Thus, the average number of such courses reported for them in Table 8 would be increased more than for other occupational program students if courses taken in earlier years were included.

Although the vocational courses taken by the average occupational major appear to involve substantial investments of time, these students' nonvocational courses do not. This may be seen from the fact that while vocational students enroll in about 24 nonvocational courses over the last three years of their high school careers, this instruction is the equivalent of only 18 FTE semester courses. Distribution students are exposed to the least amount of nonvocational coursework. Since the nonvocational courses taken by vocational students average less than one FTE semester course apiece (compare the last two columns of Table 8), these courses must tend to be shorter than 18 weeks in duration or to meet less frequently than five times a week.

It should be apparent from these discussions of the data in Table 8 that there are large differences in the educational careers of students in the various occupational program areas. Agriculture students enroll in a program early in high school, they take few vocational courses each year on the average, and two-thirds of that instructional time is outside the program area. Distribution students tend to enroll in their program during the last year or two of high school, they take little vocational education either in their program area or in other areas, and they end up with a total of only 23 FTE semester courses during the last three years of high school--vocational and nonvocational combined. (Since Table 8 is based on high school seniors, dropout rates in earlier years do not affect these course totals.) Most health students enroll in the program in their senior year, in part because many schools require them to complete certain required academic courses first, and then they take health courses that average almost twice the standard number of hours each week. Office students take few vocational courses outside their program area, and they take more nonvocational courses on the average than do students in the other occupational programs. Technical/trade students are exposed to more vocational training in their program area than are other occupational students, and they take the fewest vocational courses outside their program area. Although, upon reflection, this diversity is to be expected, it may often be forgotten and bear repeating: there is a great deal of variety in the educational "life-cycles" of the various occupational programs, and consequently they should not be treated as one big, homogeneous conglomeration.

In summary, it appears that occupational program students are receiving sufficient amounts of vocational instruction on the whole. This finding is obscured when dealing in enrollments or even unduplicated counts of students and only becomes apparent when course exposure is taken into account and contact hours or full-time equivalent course loads are calculated. The reason is that many vocational classes, especially in the health and trade-industry areas, are two or three school periods long. If there are any grounds for possible concern, at least as of the early 1970s, they are (1) that distribution program majors average only 2.6 FTE semester courses in their program area by the end of their senior year, and (2) that occupational students tend to take nonvocational courses that involve fewer contact hours than the standard semester course.

4.0 Participation in Occupational Education at Present and through the 1980s

In the second section, we examined the most recently published BOAE statistics for course enrollments in vocational programs (FY 1978) and discussed some of the ways in which these counts may be unreliable and may overestimate participation in occupational education. In particular, that review included a short discussion of various ways by which enrollment counts can become duplicated and the problems with treating course enrollment counts as though they were unduplicated student counts. In the third section, we used an independent data source from October 1972 to decompose gross vocational enrollments into unduplicated counts of persons taking one or more vocational courses and to convert these counts into full-time equivalent program and non-program students. When compared to BOAE statistics for school year 1973, the estimated number of unduplicated secondary students enrolled in occupational programs was 38 percent lower than the number of occupational program course enrollments reported by BOAE (2.5 million program students vs. 4.0 million course enrollments), with varying discrepancies by program area. With what we have learned from the NCES survey, we can now return to the BOAE summary statistics for 1978 and other recent data sources to provide estimates of the number of secondary students currently enrolled in occupational programs and to forecast levels of activity in the near future for vocational education.

Table 9 contains estimates for school years 1978 through 1987 for (1) the total number of secondary public school enrollments, (2) the total number of students in occupational programs, and (3) the number of students enrolled in each of the seven program areas. The forecasted total secondary enrollments come from Projections of Educational Statistics to 1986-87[16] and are considered to be quite accurate since the number of elementary students who will enter high school in future years is known and, for the near future, the projections are not affected by changing birth rates. In contrast, the estimated numbers of occupational program students, overall and by program area, are based on a number of simplifying assumptions and are intended to serve only as probable upper and lower limits for a range of reasonable estimates. For each subset of occupational program students, three estimated numbers are provided for school year 1978 (the most recent year for which statistics have been published by BOAE), and two forecasted trends are presented through school year 1987. One forecast is probably too low, and the other forecast is probably too high.

Estimate 1 is based on the NCES survey together with BOAE course enrollment counts. Using the unduplicated program student counts derived from the NCES survey conducted in October 1972 and the program enrollment counts published by BOAE for school year 1973, ratios of unduplicated students to course enrollments were calculated for all occupational program activity and separately for each of the seven program areas. These ratios were then used to estimate the number of program students in school year 1978 from the BOAE course enrollment counts for that year. Thus, Estimate 1 assumes (1) that the procedures by which the BOAE enrollment counts were collected, tabulated, and reported did not change between 1973 and 1978 and (2) that the ratios of unduplicated students to course enrollments have not changed. The BOAE summary statistics show a 25 percent increase in secondary occupational program activity between 1973 and 1978. If this increase resulted almost entirely from an increased

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16 Projections of Educational Statistics to 1986-87, Martin M. Frankel, National Center for Education Statistics, Washington, D.C., U.S. Government Printing Office, 1978, Table 3, p. 16.

TABLE 9

Estimated Numbers of Students in Occupational Programs by Occupational Area, 1978-1987 (numbers in thousands)

Program Area	School Year Ending in									
	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Total Public Secondary School Enrollments	14,234	14,075	13,711	13,203	12,676	12,166	11,899	11,894	11,963	11,812
Total Number of Students in Occupational Programs										
Estimate 1[a]	3,081	—	—	—	—	—	—	—	—	—
Estimate 2[b]	2,524	2,496	2,431	2,341	2,248	2,157	2,110	2,109	2,121	2,095
Estimate 3[c]	3,089	3,165	3,192	3,177	3,150	3,119	3,144	3,236	3,350	3,401
Agriculture										
Estimate 1	608	—	—	—	—	—	—	—	—	—
Estimate 2	540	534	521	501	481	462	452	452	454	449
Estimate 3	613	619	616	605	593	580	578	589	603	606
Distribution										
Estimate 1	249	—	—	—	—	—	—	—	—	—
Estimate 2	194	192	187	180	173	166	162	162	163	161
Estimate 3	245	251	254	252	251	248	250	258	267	272
Health										
Estimate 1	125	—	—	—	—	—	—	—	—	—
Estimate 2	73	72	70	68	65	63	61	61	61	61
Estimate 3	120	127	132	135	137	137	142	149	157	162
Occupational Home Economics										
Estimate 1	223	—	—	—	—	—	—	—	—	—
Estimate 2	166	164	160	154	148	142	139	139	139	138
Estimate 3	223	231	234	235	235	234	237	245	255	260
Office										
Estimate 1	719	—	—	—	—	—	—	—	—	—
Estimate 2	609	602	586	564	542	520	509	508	511	505
Estimate 3	716	729	731	724	714	702	704	722	744	751
Technical										
Estimate 1	130	—	—	—	—	—	—	—	—	—
Estimate 2	130	129	126	121	116	111	109	109	110	108
Estimate 3	121	118	114	107	101	96	92	90	90	87
Trade and Industry										
Estimate 1	1,028	—	—	—	—	—	—	—	—	—
Estimate 2	812	803	782	753	723	694	678	678	682	674
Estimate 3	1,025	1,054	1,068	1,067	1,062	1,055	1,066	1,101	1,142	1,163

Footnotes for Table 9 on next page.

Footnotes for Table 9

[a]Estimate 1 was calculated by using BOAE vocational program enrollment data for school year 1978 and assuming that the ratio of unduplicated students to course enrollments within program areas and overall was the same as in school year 1973 (unduplicated students from the NCES survey and course enrollments from 1973 BOAE summary data).

[b]Estimate 2 was calculated by using NCES projections of total enrollments in grades 9-12 through school year 1987 and assuming that the proportion of those students in occupational programs will be the same as in school year 1973 (from the NCES survey).

[c]Estimate 3 is based on BOAE vocational enrollment data from school years 1973, 1976, and 1978, the NCES survey from October 1972, and NCES projections of total enrollments in grades 9-12 through school year 1987. The NCES survey data were used to convert BOAE course enrollment counts to unduplicated student counts by assuming that the ratio between the two was the same as in school year 1973. These student counts were then converted into percentages of the total enrollment in grades 9-12 through school year 1978. Trends in these percentages were computed, separately for all occupational program students and within programs, and these linear trends were projected through school year 1987. Finally, the projected percentages for each year were converted back into estimated numbers of students. Since trends in the separate program areas were computed independently from the overall trend, Estimate 3 for the seven program areas in a particular year do not add to equal Estimate 3 for the total number of occupational program students.

SOURCE: Special Tabulations, NCES Survey of Public Secondary Vocational Education, October 1972; BOAE Summary Data for Vocational Education, FY 1973, 1976, 1978; Projections of Education Statistics to 1986-87, National Center for Education Statistics, Table 3, p. 16.

proportion of secondary students enrolling in occupational programs, then Estimate 1 may be fairly accurate; if, on the other hand, the 25 percent increase resulted partly from changed accounting and reporting procedures used by the states, Estimate 1 is probably an overestimate.

Estimate 2 is based on the NCES survey and projected total public secondary school enrollments for the school years from 1973 to 1987. The unduplicated counts of students in occupational programs from the NCES survey were converted into proportions of the total enrollment in grades 9-12 in 1973 (e.g., 17.7 percent of public secondary students were enrolled in an occupational program). These percentages were multiplied by the projected public secondary school enrollments to produce estimated numbers of students in occupational programs in current and future years. Thus, Estimate 2 does not take into account the dramatic increase in BOAE vocational statistics after 1973 but instead assumes that the proportion of high school students enrolled in the various occupational programs has remained unchanged. If this is true, Estimate 2 may be fairly accurate; if, on the other hand, the proportion of high school students enrolled in occupational programs has actually increased, then Estimate 2 is an underestimate.

Estimate 3 is similar to Estimate 1 except that trends in BOAE course enrollment statistics and projected total secondary enrollments were used to produce a forecast through 1987. In particular, BOAE course enrollment counts from past years were converted into unduplicated student counts by using the ratios between the two in 1973 (as was done in calculating Estimate 1), and then these student counts were converted into proportions of the total public secondary enrollment in that year. Linear trends in these proportions were computed for each occupational program area and, separately, for all occupational program students, and these trends were projected out to 1987. Finally, the projected proportions were reconverted into numbers of students. Thus, Estimate 3 assumes (1) that the data collection and reporting procedures behind the BOAE statistics did not change, (2) that the ratios of unduplicated students to course enrollments did not change between 1973 and 1978, and (3) that the trends reported by BOAE between 1973 and 1978 (expressed as a proportion of all

high school students) would continue for the next nine years. Since Estimate 3 is merely a more sophisticated and projected version of Estimate 1, it should not be surprising that the two are very similar in 1978, and one should not assume that these estimates are more accurate than Estimate 2 merely because they seem to "outvote" Estimate 2. The conditions under which Estimate 1 would be accurate or an overestimate also apply to Estimate 3. In addition, if the computed trends between 1973 and 1978 do not continue unabated through 1987 (and they would have to level off eventually since there cannot be more than 100 percent or fewer than 0 percent of all high school students in a program area!), then Estimate 3 would overestimate the total numbers of students.[17] Because the trend for all occupational students was computed separately from the trends in the occupational areas, the sum of the projections for the seven areas does not necessarily equal the projection for all occupational programs.

Given the assumptions on which Estimates 2 and 3 are based, the directions in which those assumptions are probably incorrect, and the effects of the assumptions on the final estimates, it appears likely that the truth is somewhere betwixt and between. While Estimate 2 assumes that occupational program students will continue to make up 17.7 percent of all high school students, with numbers decreasing from 2.5 million in 1978 to 2.1 million in 1987 because of declining secondary enrollments, Estimate 3 projects the proportion as increasing to 21.7 percent by 1978 and 28.8 percent by 1987, with numbers increasing from 3.1 million in 1978 to 3.4 million in 1987. The two estimates become most divergent for the program areas that appeared to be most rapidly increasing in size between 1973 and 1978, namely, health, occupational home economics, and trade and industry. Conversely, the two estimates are most similar for program areas that do not appear to be rapidly increasing or decreasing their shares of high school students, such as the technical and agriculture areas.

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17 The one exception is the technical area, which has experienced declining enrollments as a proportion of all high school students according to the BOAE reports. Consequently, Estimates 1 and 3 of the number of Technical program students are probably too low, and Estimate 2 is probably too high.

Unfortunately, these projections do not tell us whether the total number of occupational program students is likely to rise or fall in future years. We know that secondary enrollments will continue to fall through the 1980s before beginning to rise again (when the children of the last baby boom cohorts start entering 9th grade in large numbers). If the proportion of students in occupational programs increases, it may offset or more than offset the decline in secondary enrollments over the next few years; if the proportion enrolled in occupational programs stays steady, total numbers of students will decline, as will the demand for vocational education teachers and facilities. According to the statistics published by BOAE, occupational education is a growing enterprise. However, since the NCES survey of public secondary vocational education has not been replicated since October 1972, we do not know whether the BOAE statistics have continued to be as accurate (or, depending on your point of view, inaccurate) as they were then and can be interpreted in the same way or whether the recent "growth" in occupational education is largely caused by reported course enrollment counts that increasingly overstate the actual amount of activity in vocational education.

5.0 Conclusions and Implications

In the preceding sections, a number of points were made that are vital to a clear understanding of secondary vocational education in the country today.

(1) Official BOAE statistics should not be interpreted as unduplicated counts of students enrolled in occupational programs. Such an interpretation would overstate the number of occupation program majors in 1973 by more than 60 percent, and we have no reason to believe that the official statistics are any more accurate today.

(2) Contact hours, full-time equivalent students, or some comparable statistic is a better measure of total effort and exposure in vocational education than counts of course offerings, course enrollments, or unduplicated students. The advantage of being enrolled in a vocational education program, as opposed to taking vocational electives, becomes apparent only when courses are weighted by contact time per course.

(3) The academic "life-cycles" of the various occupational programs are quite different from one another in terms of the average number of years students are enrolled in the program, number of courses taken, and the intensity of those courses. Because of this diversity, generalized statements about all vocational students are probably inaccurate for most individual students.

(4) Because of the dubious accuracy of available statistics, it is problematic trying to estimate the actual number of current vocational students, let alone forecast their numbers in future years. We have produced high and low projections that almost certainly bound the range of reasonable estimates, however: a high projection of 3.2 million unduplicated occupational program students in public secondary schools in 1980 increasing to 3.4 million by 1987 and a low projection of 2.4 million occupational program students in 1980 decreasing to 2.1 by 1987.

In addition to the points that were made earlier, two other kinds of implications follow logically from the findings presented in this paper. First, although there are no reliable figures on the cost of vocational education, reductions in the estimated number of vocational students will certainly increase the estimated cost per student. For example, if the number of unduplicated occupational program students was overstated by 60 percent by official statistics in 1973, then the cost per student calculated with those figures would be understated by a like amount, and similar arguments would hold for more recent cost estimates. Costs per full-time equivalent vocational student, which are more appropriate for comparisons with the costs of other kinds of secondary education, will be even higher--approximatley three times higher.

Second, we have found strikingly different patterns of educational exposure in terms of intensity and duration for students in the various occupational program areas. This has implications for future effectiveness studies of vocational education. In contrast to most past research in this area, comparisons of all vocational education students to all other students can no longer be considered acceptable. Grouping all vocational education students together and treating them as a homogenous

conglomeration can lead only to false conclusions, at least conclusions that are false for most vocational students. Differential exposure by program area must be taken into account. In addition, there are probably as large differences in exposure and types of courses taken within programs as between programs. Effectiveness research should look at individual vocational students and their activities rather than analyze averages computed over nonhomogeneous groups. Future research should also include other variables that have largely been neglected in the past, such as the type of secondary school attended and the amount and type of exposure to cooperative education and work-study programs.

Alternate Version of Table 8:

Number and Full-Time Equivalent (FTE) Semester Courses Taken
in Grades 10-12 by Public High School Seniors in Occupational Programs

Program Area	Mean Years in Program[a]	Total Voc. and Nonvoc. Courses		Vocational Education Courses						Nonvoc. Courses	
				Total Voc. Courses		Voc. Courses in Program Area		Voc. Courses Outside Program			
		#	FTEs[b]	#	FTEs[b]	#	FTEs[b]	#	FTEs[b]	#	FTEs[b]
Average of All Students in Occupational Programs[c]	2.1	32.8	28.3	8.7	10.6	6.6	8.5	2.2	2.1	24.1	18.1
Agriculture[d]	3.1	31.5	29.3	9.2	10.5	5.9	5.8	3.3	4.7	22.3	18.8
Distribution	1.5	28.9	23.1	7.5	7.0	4.1	4.2	3.4	2.8	21.4	16.1
Health	1.3	31.7	31.3	9.1	13.9	4.9	8.9	4.2	5.0	22.6	17.4
Office	2.2	36.1	29.3	9.7	9.9	7.8	8.4	1.9	1.5	26.4	19.4
Technical/Trade	1.9	31.3	29.5	8.0	12.1	6.6	10.8	1.3	1.3	23.3	17.4

[a] Mean years enrolled in the occupational program by the end of the senior year assuming that all students enrolled in a program at the beginning of a school year; based on NCES file.

[b] Total classroom contact time converted to full-time eqivalent (FTE) semester courses, with one FTE semester course being equal to 90 classroom hours (5 hours per week for 18 weeks); classroom contact time based on NCES file.

[c] When aggregating statistics for the five program areas, each program was weighted by the number of high school seniors enrolled in that program in the NCES survey.

[d] Students were assigned to program areas according to school records concerning their majors (with the exception of Column 1 based on the NCES file in which students were assigned to program areas according to their self-reported majors).

SOURCE: 1972 National Longitudinal Survey (NLS); Special Tabulations, NCES Survey of Public Secondary Vocational Education, October 1972.